Comments for Draft Revisions *(Not Applicable to Directives; Refer to Directive Management Officer for Directive Comment Format)*

For detailed instructions on how to fill out the columns below, please see the Instructions sheet.

Comments Submitted By:	
Organization:	Garmin International (1-5), GE Aviation (6-9), United Technologies (10-11), Embraer (12), Boeing (13)
Phone:	

#	Document Name	Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution	Comment Type (Conceptual, Editorial, or Format)	Disposition/Response to Comment
1	DataIntAC	1	1	"This report may help you assess and select an optimum data integrity algorithm for your specific application…"	"Optimum" may not be needed or desirable. The report can be used to assess and select, whether the selection is optimum or not.	Remove the word "optimum" from the sentence.	Editorial	Comment Accepted
2	DataIntAC	1-2	4.a.	All listed related publications.	The list of "related publications" seems unnecessarily long. It is unclear how or why all of these advisory circulars are related. As noted in the Background section, CRC performance is primarily used within the safety assessment process. Although data integrity is a part of software and complex electronic hardware processes, the assessment needs to happen in the context of safety assessment.	Remove all the ACs in this section except for AC 23.1309-1, AC 25-1309-1, AC 27-1309 and AC 29-1309.	Conceptual	Comment Not Accepted: This list references advisory circulars which depend, at some point, on having data integrity for transmitted data, program memory, software loading, etc. The presence or absence of these references does not change the intent of this AC and will impose no burden upon the user of this AC.
3	DataIntAC	2	4.a.(4)	AC 20-170, *Integrated Modular Avionics Development, Verification, Integration and Approval using RTCA/DO-297 and Technical Standard Order C-153* .	AC 20-170 is not numbered in the correct format.	If AC 20-170 is included in the document (see previous comment), add correct numbering format, item (5), and adjust other numbering accordingly	Editorial	Comment Accepted
4	DataIntAC	2-3	4.b.	All listed related publications.	The list of "related publications" seems unnecessarily long. It is unclear how or why all of these industry documents are related. As noted in the Background section, CRC performance is primarily used within the safety assessment process. Although data integrity is a part of software and complex electronic hardware processes, the assessment needs to happen in the context of safety assessment.	Remove all the references in this section except for ARP 4754A.	Conceptual	Comment Not Accepted: This list references publications which depend, at some point, on having data integrity for transmitted data, program memory, software loading, etc. The presence or absence of these references does not change the intent of this AC and will impose no burden upon the user of this AC.

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5	DataIntAC	3	6	"Integrity of digital data is necessary to ensure performance of intended function, and thereby meet the applicable airworthiness regulations. However, airborne systems that have undetected data errors resulting from bit flips or bit shifts due to signal noise, electromagnetic interference, single event effects, or some other anomaly, could have serious operational safety consequences. The standard process used for the System Safety Assessment (SSA) of airborne systems requires that the system designers consider potential failure modes and the effects those failures may have on not only that system, but any "downstream" system that uses data from that system. Airborne systems that use digital technology can experience faults or failures that will result in the loss of integrity of safety related digital data in addition to physical failures of components. Designers of these airborne systems should assess how the loss of integrity of safety-related digital data can occur, and include that assessment in the appropriate SSAs. Depending on	As noted in the Purpose paragraph, "This report is provided for information only." The first paragraph in the Background paragraph then goes on to state things like, "Designers of these airborne systems should assess" and "system designers will likely need to provide mechanisms". Use of statements like these invite the use of the report as guidance or even requirement.	Delete the first paragraph of Paragraph 6.	Conceptual	Partial Acceptance. The next-to-last and the last sentences of the first paragraph of Paragraph 6 were deleted. These are the sentences with stated "should assess" and "will likely need to provide". The remainder of the first paragraph solely provides background information.
6	Selection of Cyclic Redundancy Code and Checksum Algorithms to Ensure Critical Data Integrity	36	6.4 fig 8	Figure 8	The proposed Criticality Mapping Flow does not account for this being one small piece of the Safety Assessment Process.	Suggest stronger ties to the ARP4761 safety process. The maximum allowable probabilties must flow from a broader safety analysis that accounts for all the failure modes that contribute to a failure condition. E.g. if a failure condition must occur at a rate less than 1E-9 per flight hour, the allocation to a memory upset or data transport upset would be much less than 1E-9, like on the order of 1E-10 or 1E-11.	Conceptual	Comment Not Accepted. This comment is about the research report itself and not the AC. While this comment may be valid in context of the research report, it is out of scope for the review activity for the AC itself.

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7	Selection of Cyclic Redundancy Code and Checksum Algorithms to Ensure Critical Data Integrity	38	6.9	All references to "worst case"	The safety process used to show compliance to 25.1309 is based on the concept of average risk. References to worst-case environment and worst-case dataword patterns imply this document is driving down a path or worst case risk, not average risk. Always referencing the worst-case goes beyond the generic approach of adding conservatism to a safety analysis. Note: This comment doesn't apply to references to worst-case failure condition or hazard.	Worst case should not be used for determining what the average probability of an error resulting in a failure condition without guidance on determing the probability of the worst case condition occuring.	Conceptual	Comment Not Accepted. This comment is about the research report itself and not the AC. While this comment may be valid in context of the research report, it is out of scope for the review activity for the AC itself.
8	Selection of Cyclic Redundancy Code and Checksum Algorithms to Ensure Critical Data Integrity	38	6.9		This section talks a lot about BER for data-transfer systems, but is missing similar guidance for memory. Concerned that the data-transfer guidance will be erroneously applied to memory without additional text to either add guidance or highlight the limitiations of the guidance provided.	Update the process flow description to account for all three cases introduced (Data-tranfer, memory, and transferable media)	Conceptual	Comment Not Accepted. This comment is about the research report itself and not the AC. While this comment may be valid in context of the research report, it is out of scope for the review activity for the AC itself.
9	Selection of Cyclic Redundancy Code and Checksum Algorithms to Ensure Critical Data Integrity	45	6.17		Why is this guidance limited to single bit flips in memory? I think this document needs to highlight the importance of understanding the error/fault model when determining if a CRC/Checksum is good enough, not just assuming a single-bit flip fault model.	Add content to address muliple-bit fault model, or state explicitly the limit of the guidance	Conceptual	Comment Not Accepted. This comment is about the research report itself and not the AC. While this comment may be valid in context of the research report, it is out of scope for the review activity for the AC itself.
10	Selection of Cyclic Redundancy Code and Checksum Algorithms to Ensure Critical Data Integrity		0 general		If the goal is to improve the state of aviation for SEU and transmission errors, then the AC should address other methods of ensuring the integrity of the data. Other methods may be better suited to eliminating bit errors, such as Golay codes, hamming codes, hadamard code, etc. This draft AC leaves the impression that a CRC is the best method for eliminating this type of problem.		Conceptual	Comment Not Accepted. The purpose of this AC is solely to reference this specific research report as potentially helpful. The FAA acknowledges that the report does not address the full suite of methods that may help to ensure data integrity.
11	Selection of Cyclic Redundancy Code and Checksum Algorithms to Ensure Critical Data Integrity		0 general		The topic in the linked to article http://www.tc.faa.gov/its/worldpac/techrpt/tc14-49.pdf is interesting, however a study of CRC and checksum algorithms should really consider using formal methods. The existing paper uses monte carlo simulations extensively in order to locate better polynomials for CRCs. A more exhaustive search utilizing formal methods could yield a much improved search with more certainty in the results.		Conceptual	Comment Not Accepted. The purpose of this AC is solely to reference this specific research report as potentially helpful. The FAA acknowledges that the report does not address the full suite of methods that may help to ensure data integrity.

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12	AC 00-XX	N/A	N/A	N/A	FAA has several research reports available on its Aircraft Certification Software web link, which provide useful information but are not included in any Advisory Circular.,e.g., DOT/FAA/AR-09/24, -09/27, and -11/2. This AC 00-XX states that the DOT/FAA.TC-14/49 report "is only provided for information only and, as such, is not intended as guidance but rather as reference material for the aviation industry." Likewise, the other aforementioned reports are also reference material for aviation companies.	Embraer suggestions FAA to make clear the criteria to publish these reports as Advisory Circulars.	Conceptual	Comment Not Accepted. FAA Order O1320.46D Chapter 3, 1.a.provides reasons for writing an AC. This includes to "(5) Help the industry and the FAA effectively implement a regulation." and and to "(7) Expand on standards needed to promote aviation safety…" The topic areas for a 00-series is General, including definitions and abbreviations which we believe encompasses best practices. Also, as noted, the AC specifically says that it is not guidance.
13	AC 00-XX	N/A	N/A	N/A	In general, we are puzzled as to why the FAA has prepared this AC. The proposed text indicates that the AC merely provides information about the availability of resource material on digital data integrity; this information is in the form of a research report that is posted on the FAA Technical Center's web site. The proposed AC does not appear to meet the criteria for publishing an AC, as stated in FAA Order 1320.46D (FAA Advisory Circular System), chapter 3, paragraph 1.a. It contains no guidance, methods, procedures, or practices for complying with any regulation. The report is useful information to consider when evaluating the use of data integrity checks, but not as a means of compliance. Given that there is no direction contained in the proposed AC, it is unclear what the FAA's expectations are of applicants. The Technical Center regularly posts reports on its web site, but this is the first time we have seen an AC issued to announce the availability of a posted report, accompanied with a request for public comments on the AC. We ask whether this is to become a normal procedure. If so, we maintain that FAA's resources, as well as those of the public, should be more appropriately prioritized to address specific safety-related issues. Further, our technical subject matter experts have reviewed the report cited in the AC, and have found several problems with it, as currently written, for example: • The report contains some obsolete information on ARINC 825, The General Standardization of Controller Area Network (CAN) for Airborne Use. • The report does not account for the holistic failsafe design process, which includes architectural/design mitigations, failure mode occurrence/rate assessments, and other relevant safety analyses/testing. In light of this, we recommend that the FAA withdraw this proposed AC and		Conceptual	Comment Not Accepted. FAA Order O1320.46D Chapter 3, 1.a.provides reasons for writing an AC. This includes to "(5) Help the industry and the FAA effectively implement a regulation." and and to "(7) Expand on standards needed to promote aviation safety…" A topic area for a 00-series is General, including definitions and abbreviations which we believe encompasses best practices. Also, as noted, the AC specifically says that it is not guidance. In addition, the purpose of this AC is solely to reference this specific research report as potentially helpful. The FAA acknowledges that the report does not address the full suite of methods that may help to ensure data integrity.

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